International Journal of Entomology Research
ISSN: 2455-4758
www.entomologyjournals.com
Volume 1; Issue 2; February 2016; Page No. 16-22

Insect pests of honey bees and choosing of the right management strategic plan

Muhammad Sarwar

Nuclear Institute for Food & Agriculture (NIFA), Tarnab, Peshawar, Pakistan.

Abstract
Like all living creatures, honeybees are subjected to attack at all stages of development by various insect enemies acting directly as predators or indirectly by disturbing of colony. This article deals with most common insect enemies of honeybee, describes their harmful effects and gives clear indication of means to protect hive and hive products. The most important of these enemies are those that destroy combs, stores, hive and some predators that take foraging worker as they leave hive, or those that behave as true parasites by raising their offspring in bodies of bees. Control of moth can be undertaken by damaged and invaded comb cut out, and weakened colonies united to strengthen them. It is advisable to maintain strong colonies and provide appropriate number of frames according to size of colony. To destroy insects in larval stage, infested combs must be removed from hives and fumigated with chemical products or subjected to high or low temperatures. It is recommended that apiaries be moved away from heavily infested areas so that adults are deprived of bees and local populations of predator are thus reduced. Although ants and yellow jackets are not usually serious pests of beehives, their presence may indicate colony weakness, however, they tend to bother apiarists more than they bother honey bees themselves. Ants can be controlled by treating their nests with an approved insecticide; as such materials are generally highly toxic to bees and should not be used close to hives. Single colonies can be placed on stands or benches protected by oil or sticky barriers to avoid roaches, earwigs, praying mantids, termites and lice. Colonies should be carefully inspected for signs of infestation, maintain healthy hives capable of protecting all comb hive and carefully inspect honey bee packages received from areas where beetles are established.

Keywords: Insects, Pests, Honey bees, Colony loss

1. Introduction
All living organisms are subjected to infestation or attack by their natural enemies, and honey bees of the genus *Apis* are no without exception. Through their long history of evolution and natural selection, they have achieved a high level of sociality and many thousands of individual bees are living together in a tightly knit social organization. Currently, the most serious arthropod pests of honey bees are wax moths and small hive beetles, although the latter have not been as prevalent in recent years. Minor pests include meal moths, bee lice, and other nuisance pests such as ants, other bees, dragonflies, earwigs, hornets, roaches, termites and wasps. Insect pests feeding on bees cause damage to hive comb and spread various diseases within colony. Virtually, bee hives are attractive to termites attack on wooden hive parts, earwigs and roaches live inside covers, yellow jackets are common hive scavengers, and more than a dozen of other types of insects and related arthropods can be found inside a bee colony. Outside, spiders and other predatory insects may feast on bees captured at the entrance or at flower foraging sites [1].
The maintaining of gentle, manageable stock is especially important in severely predator's populated areas. A number of preventive or control management practices to minimize the effects on honey bee pests are practiced. If bee colonies exhibit the above characteristics, requeening with healthy stock is highly recommended. The program involves a range of surveillance methods conducted at locations considered to be the most likely entry point of bee pests and predators throughout the territory. Maintain colony strength, keep bottom boards raised off the ground, remove debris from around the bottom of the hive, use ant barriers around colonies, or place single colonies on stands surrounded by oil or sticky traps. For wasp's control, use traps baited with meat or other attractants coated with soft insecticides. Strengthening of honey bee colonies via feeding, removing unoccupied suppers and combs, and trapping adult wax moths are tested against wax moths and resulted in reduction of infestation level of pests by 82.3% and increasing honey bee. Three different ant protection methods such as inner tube, smooth iron sheet and tin filled with used engine oils are tests for their effectives in preventing access of ants by exposing to massive raids of ants, and the tin filled with used engine oil methods has been found the best in totally protecting honey bee colonies. In the present review an attempt has been made to briefly discuss the major honey bee insect pests and predators, and their disturbance in the country so as to help the researchers to develop efficient methods for prevention, control and management to improve productivity and the health welfare of bee populations [2].

2. Pests of Honey Bees
A numbers of invertebrate pests belong to insect orders themselves such as ants, beetles, moths, lice, termites, etc., raid bee colony as detailed in the underlines.

2.1. Lepidoptera
Adults Lepidoptera insects are characterized by possession of four wings covered with scales and their mouth parts are specialized for feeding on the nectars of flowers and other liquids, and they are considered as harmless to bees, by contrast to caterpillars (larvae) having masticatory mouthparts for feeding primarily on plants. The Rhopalocera or butterflies have

a thin, fragile and elongated body, large, broad wings characteristically assume a vertical position at rest, long thin antennae are club-shaped and their posterior wings are hairless and not harmful to bees. The Heterocera or moths, have a broad and solid body, short, thick, prismatic antennae and unequal wings; the anterior wings being lengthened and narrow, while the posterior wings rather rounded and hairy. The Sphingidae family belonging to the second group includes the species *Acherontia atropos*, the deathhead moth, which is a notorious enemy of the bee. But, within the family Pyralidae that insects are to be found which cause the greatest damage to hives such as *Galleria mellonella* and *Achroea grisella* moths. Of the two wax moths, the greater wax moth is considered the most destructive and larvae of this moth cause considerable damage to beeswax combs left unattended by bees [3].

The greater wax moth (*Galleria mellonella*) is often reported to cause damage both to honey bee colonies and to bee products in tropical and sub-tropical Asian countries. Empty combs, rendered wax, comb foundation and bee collected pollen, if are not properly stored and left unattended, almost always suffer considerable damage from wax-moth infestation. According to many reports, the wax moth is a major pest of *Apis cerana*, often causing colonies to abscond. In wax-moth attacks on colonies, the adult female enters the hive at night through the entrance or cracks in the walls, deposits its eggs directly onto the combs or in narrow crevices that permit oviposition and offers protection against removal by worker bees. The adult moths are gray-brown and about 3/4 inch long, and in the daytime they are usually seen resting with their wings folded like a tent over their bodies. When disturbed, the moths usually run rapidly before taking flight. From 50 to 150 eggs are laid in each batch; they are glued together and adhere firmly to the surface on which they are laid. Caterpillars hatch three to five days later and tunnel through the wax combs, feeding on pollen, cast skins and cocoons, leaving webbing and frass behind. The grayish-white larvae are kept under control by the bees in normal colonies and do no harm. They may completely ruin the combs in weak or dead colonies and in stored equipment. Unless they are controlled, they feed on the cocoons, cast skins, and pollen in the combs, and reduce them to a mass of webs and waste products The newly-hatched *Galleria* larvae feed on honey and pollen, and then burrow into pollen storage cells or the outer edge of cell walls, later extending their tunnels to the midrib of the comb as they grow. At this stage the developing larvae are quite safe from the worker bees. As they advance into the combs, they leave behind them a mass of webs and debris; the complete destruction of unattended combs usually ensues within 10-15 days. In addition to stored pollen and comb wax, larvae of the greater wax moth can also attack bee brood when short of food. The development time of *Galleria* larvae depends on two factors, the food availability and temperature. Whereas, in tropical climates the larvae require only 18-20 days before spinning cocoons and becoming pupae, and in cooler climates this period may be extended. Cocoons are visible among the webbing and on the frame top at the bottom of the illustration. When weak colonies are infested, the symptom of 'galleriasis' is frequently observed, and the emerging adult worker and drone bees are unable to leave their cells because their bodies have been tied up by silken threads spun by the *Galleria* larvae. Caterpillars move out of comb to pupate, taking four weeks to several months to become adults. There are no easy or inexpensive chemotherapeutic measures for controlling of the wax moth in living honey bee colonies once infestation has set in. The only possibility is treatment with *Bacillus thuringiensis*, in a watery suspension, sprayed onto the combs. The effect on the wax-moths larvae persists for several weeks. Preventive measures include ensuring that the colonies, whether of *A. cerana* or *A. mellifera*, are strong and have adequate food stores; adapting the hive space to the strength of the colony; reducing the hive entrance; sealing cracks and crevices in hive walls; protecting the colonies against pesticide poisoning; controlling pests and diseases that might otherwise weaken them; and removing any wax and debris accumulated on the bottom boards of the hives. Several measures can be taken to prevent or control wax-moth infestation in stored combs and hive products. Products that are vulnerable to wax moth attack such as empty combs, used hive parts and wax should be properly stored, preferably in tight, moth-proof rooms. As preferably formerly hedged combs are infested, they should be stored apart from new ones. Fumigation is the usual treatment and new combs should be treated less frequently. Among the most commonly used fumigants are naphthalene, ethylene dibromide and methyl bromide. All, including para-dichlorbenzene, are very poisonous to bees and humans and, in addition, lead to residues in honey. The application of sulphur, however, is inoffensive. Sulphur powder is wrapped in newspaper and burned in a metal container or liquid sulphur from sprayers can also be used. The development of wax moths can be interrupted for several months if the combs are heated at 48°C (118°F) for three hours. All treatments should be repeated at intervals depending on the level of infestation, as a result regular pest control is therefore recommended. The best defense against wax moths is to maintain strong, healthy colonies. Strong colonies can defend themselves against wax moths, whereas weak colonies cannot. Comb honey and equipment stored off colonies must be protected from this pest. During the winter, store honey and brood combs in an unheated shelter to prevent wax moth damage. During periods when wax moths are problematic (summer and fall) store honey supers, brood combs, and comb honey in a freezer or exposed to light twenty for four hours a day [4, 5].

The lesser wax moth (*Achroia grisella*) as its name implies, is generally smaller than the greater wax moth, except when the latter is dwarfed owing to poor diet during its larval stage. Adult *A. grisella* are silver-grey in color, with a distinct yellow head. The insect is quite small, with a slender body and normal body lengths of adult female and male are about 13 and 10 mm, respectively. The life-span of the adult female is about seven days, during which it can lay 250 to 300 eggs. The head of *A. grisella* is ochre yellow, anterior wings are brownish grey, proboscis is short and labial palps arel turned upwards in the males and forwards in the females. The caterpillars are a smaller in size than those of *G. mellonella* and they make their galleries differently. In contrast to the caterpillars of *G. mellonella*, the caterpillars of *A. grisella* cover their cocoons and galleries with their black excrement so completely that the silky threads, which constitute the basis of all their constructions, cannot be seen through this envelope. The main feature of the biology of the lesser wax moth is the difference in the life span of the male and female, which is about 23 and7 days, respectively. The youngest larvae are identical to those of *G. mellonella*, but in the hive, it is possible to distinguish them by the type of damage the larvae cause; the galleries of the lesser wax moth at the base of the cells, are straight and several centimeters long, rarely traversing the median wall. These depredations cause an abnormality in the

brood called tubular brood. Infestation by the lesser wax moth usually occurs in weak honey bee colonies. The larvae prefer to feed on dark comb, with pollen or brood cells and they are often found on the bottom board among the wax debris. As larvae prefer to form small canals between the bottoms of the brood cells the brood is lifted. The bees continue constructing cells heading upward leading to the typical scratched comb surface. The methods employed in controlling of *G. mellonella* are equally effective for the control of *A. grisella* [6].

2.2. Other Lepidoptera

Apart from the greater and lesser wax moths, various other moths species are frequently recorded in association with bees and bee products. The Indian meal moth *Plodia interpunctella* is reported to feed on bee collected pollen. Moths found dead on the bottom boards of beehives include deathhead moth or hawk moth (*Acherontia atropos*), that belongs to the Sphingidae family of moths and the genus *Acherontia.* The *A. atropos* is one of the largest moths known, its body is 5.5 cm long, width with opened wings is 11 to 13.5 cm across and caterpillar of this insect can sometimes measure up to 15 cm. The deathhead moth has scaly thorax, a deep brown color, with two crossed bones below. The deathhead moth is a nocturnal moth which enters hives to steal honey to which it is most partial, even though the adults basically feed on sap. In large numbers, it is capable of rapidly depleting the stores in a colony, but the disturbance it creates is much more serious than the loss of a few hundred grams of honey, because the queen and worker bees may abandon the hive. Several other less common moth larvae are sometimes also found in combs. They usually feed only on the pollen in individual cells and are rarely pests. Fumigation and treatment for moths can control all such pests in beehive [7].

2.3. Coleoptera

Some Coleoptera insect cause moderate damage to colonies, but most are occasional visitors to hives and feed on pollen and on debris. In general, Coleoptera are found at the bottom of weak colonies and in stored combs. In the family of Cetonidae, *Cetonia apaca* (*Cetonia carduil*) and *Cetonia morio* are two species reported to be harmful to bees. The cetonias get into the hive to feed on honey whilst digging galleries in the wax. In some areas there are massive invasions by these and the honey harvest can be compromised. The bees can combat them only with great difficulty, but it is not rare to find propolised intruders inside the hive. The *Trichodes apiarus*, which is a small black Coleopteran of the Cleridae family, having withered stripes on the elytra, haa a particular liking for umbelliferous flowers on which they lie in wait for passing insects, including foraging bees. The females look for solitary bee nests to lay their eggs, but they can also lay them in weak colonies of honeybees. Pinkish, very hairy larvae with black heads hatch out and these may or may not attack to brood and damage the wax combs. In the Ptinidae family (Spider Coleoptera), *Ptinurs fur,* can cause quite considerable damage to stored wax combs similar to that caused by the lesser wax moth and the same damage can be seen in weak colonies. This omnivorous coleopteran attacks different food sources of animal or vegetable origin and may play a role in the spread of diseases by excreting bacteria after feeding on combs from infected hives [8].

The small hive beetle (*Aethina tumida* Murray), is a newest beekeeping pest, experiencing heavy infestations, however, and has been blamed it for the quick collapse of colonies. The beetle also defecates in the honey, causing it to ferment and run out of the combs. Most vulnerable are weak hives with stored honey or full honey supers either in storage or above bee escapes. Adult hive beetle *A. tumida* is small (about one-third the size of a bee), black and covered with fine hair. When it finds a honey bee colony, the beetle lays its eggs on or near bees wax combs. The eggs hatch, producing masses of small larvae similar in appearance to wax moth larvae. They can easily be distinguished from the wax moths that may also be living in the bee colony because their legs are longer and they have a row of spines on their back and do not spin nets or cocoons. Larvae 'worms' feed on pollen and honey damaging combs, but can also eat eggs and young larvae of honey bees, and require 10-16 days to develop. After completing the larval stage, they crawl out of the hive, pupate in the soil and pupation requires 3-4 weeks. Areas of the country with sandy soils appear to be most suitable for successful small hive beetle pupation and reproduction. Larvae tunnel through comb with stored honey or pollen, damaging or destroying capping and comb. Activity of the larvae causes fermentation and frothiness in the honey with a characteristic odor of decaying oranges. Damage and fermentation cause honey to run out of combs, creating a mess in hives or extracting rooms. Heavy infestations may cause bees to abscond and some beekeepers have reported the rapid collapse of even strong colonies. Comparison of hive beetle and wax moth larvae can be made by examining their legs. Both species have three sets of legs just behind the head, but small hive beetle larvae lack the series of paired prolegs that run the length of the wax moth larva's body. Small hive beetles damage by larvae can often first be noticed by looking at the bottom board. Heavily infested colonies often have fermenting honey leaking from their entrances. While, it seems unlikely that small hive beetles actually kill colonies, weak colonies are often overrun by the larvae in a very short period of time. The best defense against hive beetles is to maintain strong, healthy colonies as strong colonies can defend themselves against this pest, whereas weak colonies cannot. In areas where this pest is found, honey removed from colonies and stored for extracting must be protected by extracting immediately or storing at low humidity less than 50 percent. A minor infestation is difficult to recognize because the beetles immediately hide in the dark. The most secure diagnosis is achieved after chemical treatment when the dead beetles can be gathered from the bottom inlay. The beetle is extremely quick moving and can fly, which contributes to its rapid spread among bee colonies and apiaries. Large hive scarab beetle (*Oplostomus haroldi*) is about 18 mm long and when present, is very conspicuous in the hive. It can vary in color from solid black to black with orange or red longitudinal stripes. This beetle is common in some areas and seems to be "tolerated" in the hive by the bees. Like the small hive beetle, it is typically considered an incidental pest, but where 200-300 of these beetles have been found in a single colony, their presence can cause a colony to abscond. Do not store honey for any length of time before extraction and keep the comb in a location with less than 50% relative humidity to keep beetle eggs from hatching. Use traps (corrugated plastic or pit traps), freeze honey, or install hot lights in honey houses to burn grubs [9, 10, 11].

2.4. Diptera

These insects have a single transparent pair of wings with longitudinal veins; the second pair of wings has been replaced by special organs, the halters. Of interest are only insects those

are true enemies of bees (predators, ectoparasites, endoparasites, saprophages and mimetics), and in certain regions some of them can cause significant damage [12].

2.4.1. Asilidae

Predatory Diptera, Asilidae or robber flies are carnivorous flies, attacking a range of insects. The relatively large adults (0.4 to 0.6 cm long) feed on flies, wasps, dragonflies, grasshoppers and moths; the bee is only one prey amongst many. The larvae live in pine stumps, especially in cut wood, and have been described as an enemy of bees and the common names given to some species of Asilidae reflect their tendency to hunt bees. For example, *Promachus fitchii*, an Asilid is known by the name of bee killer, but studies on predation by the Asilidae show that they most often feed on the larval stages of harmful insects rather than on bees and thus must be considered as useful [13].

2.4.2. Sarcophagidae

Species of Sarcophagidae family are saprophagous, *Senotainia tricuspis* Meigen is a well-known endoparasite of the honeybee and it causes apimyiasis which can sometimes be quite serious. Parasitic only in the larval stage, *S. tricuspis* females attack foraging honeybees and drones, and occasionally bumble bees and solitary bees. The female's behavior and its technique in attacking the bee are remarkable; it takes up a position, usually at hot times of the day, on the roof of a hive directly exposed to the sun. From there, it dives for the bee just as it is taking off and deposits on it one or two tiny larvae which traverse the thin membrane between the head and the thorax and finally penetrate the latter. It flies back to its position, and after a while repeats this behavior, sometimes every 6 to 10 seconds during sunny hours. After the larva penetrates the thoracic muscles, it changes into the second larval stage, which feeds on haemolymph for as long as the host survives. This larva is white with black, scythe-shaped mouthparts, 1.5 mm long and 0.5 mm wide. When the host bee dies (2 to 4 days after parasitisation), the larva feeds on the solid tissues and devours the thoracic muscles, the other soft parts of the thorax and the head. When it reaches 8 to 9 mm in size, it abandons the dead body, buries itself underground to undergo metamorphosis and changes into an adult within 7-12 days. To control *S. tricuspis*, it is recommended to paint the roof of hives (lookout spot) with a particularly resistant contact insecticide [14].

2.4.3. Braulidae

The insects called beelice are not really true lice (orders of Anoplourae and Mallophagae). The tiny adult Braulidae (1.2 to 1.5 mm long) are Diptera characterized by the absence of wings and halteres, with reduced antennae and eyes, a compact thorax and legs with claws transformed into combs specially adapted for clinging to the body of bees. Bee louse (*Braula coeca*) is wingless ectoparasitic fly and steals nectar directly from mouths of bees. The adults are small (slightly smaller than the head of a straight pin) and reddish brown in color. Although several adult flies may live on a queen, usually only one can be found on a worker. These pests do little harm, and because they are susceptible to treatments for parasitic mites and a casual glance, however, may lead one to mistake *Braula* for varroa mites because they are so similar in color and size. The *Braula* moves rapidly over the body surface of adult bees and settle on the dorsal surface at the junction of the bee's thorax and abdomen. They remain there until a hunger response causes them to crawl up to the bee's head near its mouthparts. This movement seems to cause the bee to regurgitate a drop of nectar. The bee louse then inserts its mouthparts into those of its benefactor and takes its food. The louse lays its eggs on the capping of honey storage cells from May through July. Upon hatching, the young burrow into the capping, and larva pupates inside the tunnel and these tunnels are symptomatic of the presence of immature *Braula*. Soon after emergence, the young adults crawl onto a bee and are often found on queens, but their damage to a honey bee colony is minor. A brief exposure to tobacco smoke is effective in narcotizing *B. coeca* which are then collected on an oiled sheet of cardboard inserted at the bottom of the hive prior to the operation. Chemicals such as bromopropylate and phenothiazine have been used for fumigation. To destroy the immature stages of *B. coeca*, the capping of affected honey combs can be removed [15, 16].

2.5. Hymenoptera

The order Hymenoptera comprises the bees, ants and wasps. Amongst the most interesting species, the ants (family of Formicidae) live in organized societies and this is also true for wasps in the sub-families of Polistinae and Vespinae in the family Vespidae. The most dangerous predators of bees belong to the family Vespidae (wasps and hornets) and the family Sphegidae (*Philanthus apivorous*). In some years the wasps have no hesitation in entering weak hives and taking the honey or worker bees and hornets readily choose apiaries as their hunting ground [17, 18].

2.5.1. Formicidae

Ants are among the most common predators of honey bees, and they are highly social insects and attack the hives in mass, taking virtually everything in them, dead or alive adult bees, the brood and honey. Occasionally, however, certain species may enter colonies to search for food or establish nesting sites. Ants are typically found between the inner and outer covers of the hive and in pollen traps. In addition to this destruction, they can also be a nuisance to beekeepers and may sometimes cause pain from their bites. Apiaries of *Apis mellifera* under ant attack become aggressive and difficult to manage; weak colonies can sometimes abscond, which is also the defense of *A. cerana* against frequent ant invasions. Also, they may establish their nests between the cover board and the roof, taking advantage of the warm, humid environment, which provides them with optimal nesting conditions. Queen mating nuclei containing very small populations of bees, are most vulnerable to attack by ants. Many ant genera and species are reported to cause problems to both traditional beekeeping with *A. cerana* and to modern beekeeping with *A. mellifera.* Ants also play a useful role as cleaners by removing dead or dying bees from the apiary, thus eliminating possible sources of diseases. Also, remove brush, rotten wood, grass, and weeds from around the colonies. Among the most frequently recorded species are the weaver ant (*Oecophylla smaragdina*), the black ant (*Monomorium indicum*), *Monomorium destructor* and spp., *Oligomyrmex* spp., *Dorylus* spp., the fire ants (*Solenopsis* spp.), and *Formica* spp. Some species, in particular those in the sub-families of Dorylinae and Ecitoninae, which include the army ants, are capable of destroying a whole apiary within a few hours. They behave as fearsome predators of adults, larvae and eggs. Other ants disturb the colony in their eagerness to steal honey (*formica rufa, Formica sanguínea, formica fusca, Lasius niger*) or pollen

(*Crematogaster jherinil*). Other species such as *Camponotus herculeanu* ssp. *pennsylvanicus* attack the wood of the hives or their supports [19, 20].

To minimize ant's problem, keep bottom boards of hive raised off the ground, or if ants are a persistent problem, place single colonies on stands with the legs in containers of oil or coated with a sticky barrier. Sometimes moving the colony a short distance or placing colonies in the sun rate than the shade can alleviate ant problems. Control measures against ants should only be taken in the case of persistent problems. Numerous methods commonly used are painting the hive legs with petrol or waste oil, and use of repellents placed between the roof and the cover boards (ethanol, sodium fluoride, sulphur, borax). For ant nests: apply toxic baits or spray insecticides (synthetic pyrethroid). Beekeepers have found that the most effective method of controlling weaver ants is to search systematically for the ant's nests in the vicinity of the apiaries, and when found to destroy them by burning. General recommendations to reduce ant nesting sites include eliminating brush and rotten wood from the apiary and cutting the grass. Frequent inspection and renewed application of grease are both necessary, and a more reliable method is to place the hive-stand posts in tin or plastic containers filled with either water or oil [21, 22].

2.5.2. Vespidae

Nearly in most of countries, wasps and hornets are common enemies of the honey bees, and among the most frequently reported are social wasps of the genus *Vespa*, which are widely distributed throughout the world. The social wasps of the sub-family of *Vespinae* belong to one of five genera *Provespa, Vespa* (hornets), *Dolichovespula, Paravespula* and *Vespula*. In contrast to bees which erect vertical combs, the social Vespidae build horizontal constructions made up of single rows of cells. When searching for food (two sort of substances: sweet saps of plants and small invertebrates), wasps attack different kinds of insects, including bees. The *Vespa crabo* is one of the most widespread species of hornets. This bold predator usually builds its nest in cavities in hollow trees and old walls, but sometimes underground. Its large size enables it to readily capture foraging bees at work and even at the hive entrance. The hornets have this curious attitude of swooping down on anything dark and can undertake coordinated attacks with such a great number of individuals that whole apiaries may be depopulated. The bees cannot, on their own, offer great resistance to the hornets. In view of the role played by the wasps in biological equilibrium, measures to control them should only be undertaken in extreme cases. Colonies of both *A. cerana* and *A. mellifera* are frequently attacked and hornet invasion of colonies generally causes the bees to abscond. Wasps and hornets that attack bees are *Vespa orientalis, Vespa mandarina, Vespa tropica, Vespa velutina, Vespa cincta. Vespa affinis, Vespa crabro, Vespa mongolica, Vespula lewisii* and *Vespula vulgaris.* Hornet attacks on apiaries reach their peak of intensity during September-October, whereas in tropical countries the most serious wasp invasions take place during the monsoon season, particularly from late June to August. Apiaries situated near the foothills and tropical forests suffer more acutely than those on the plains. Initially, the attacking behavior of the larger wasps, is a 'hunting phase', during which a few hornets capture and kill slow-flying bees one at a time, usually near the entrance of a weak colony's hive. Later, a 'slaughtering phase' sets in: some 20 to 30 hornets attack a weak colony in mass, using their strong jaws to maul the bees and dropping the dead and dying bees to the ground. Finally, when this phase has continued long enough for the colony under attack to have lost most of its defender workers, the hornets invade the hive itself, the honey and brood nest and the wasps carry away any surplus brood to their nest. Beekeepers sometimes adopt methods such as bait-trapping, trapping at the hive entrance and using protective screens. Locating hornet nests by following flight passes of individual wasps back to their nests and then destroying the nests may be very time consuming, and if too many of these nests are in the area, then not very efficient. As a final, and more general, recommendation for protective action against hornet attacks when the hives cannot be relocated to a safer place, beekeepers should as a minimum preventive measure narrow the hive entrance to avoid the invasion of the hive [23, 24].

2.5.3. Sphegidae

The Sphegidae constitute the most remarkable group among the predatory Hymenoptera as they have the ability to hunt and paralyze their prey with which they feed their larvae. This is nevertheless the case for *Philanthus triangulum* or *Philanthu apivorous* which most commonly hunts the managed honeybee (rarely other Apidae), sometimes killing numerous individuals. The *Philanthus* spp., the best known parasites and enemies of bees called bee wolf, is a burrowing Hymenopteran, 12 to 16 mm long, with a wide and powerful head with strong mandibles. The female deposits its eggs on the bees it captures and then transports them to its nest. The bees brought into the nest serve as food for the larvae, but they also hunt bees to feed themselves. The bee wolf female lays about fifteen eggs, each is supplied on average with 5 bees, the insect itself consumes three times more than the larva, and each *P. apivorous* can destroy three hundred bees during its life-span of a season, whereas about a hundred individuals would be sufficient to adversely affect a colony. Measures against the bee wolf are the same as those used against the ground nesting wasps, but they are much more difficult to apply because the bee wolf nests are not easy to find. When the insects appear in large numbers, the adults can readily be captured because they fly very slowly when loaded with their booty and good control can be obtained by covering the nest sites with an asphalt solution in a cold water emulsion [25].

2.6. Other Insects

Other insect pests such as dragonflies prey on bees, however, in some locations dragonfly adults may be numerous and their feeding on bees is extensive. Only the large dragonfly species are involved since most eat insects smaller than honey bees. In some areas, queen mating has been seriously disrupted due to dragonfly adults feeding on bees, including queens flying to mate in and around the apiary. There are several types of insects that may live for shorter or longer periods of time inside a bee hive or inside the inner cover of a bee hive wherein roaches and earwigs are two good examples. Most of them do no detectable harm although the beekeeper may feel their presence unsanitary or unsightly. Some may eat bees or honey while others are just after the shelter. Foraging bees may wander into the clutches of several types of predatory insects such as praying mantids, assassin bugs or beetles. Such insects are not usually very numerous and none selectively feed on honey bees over other types of insects. Meanwhile, termites are wood-infesting creatures and since most bee hives are made of wood, termites have to be listed as a hive pest. Termites are only after the wood,

but not for bees or honey. Hives placed on the ground or bee equipment left lying around on the ground or stacked directly on the ground may be subjected to termite infestation. If termites destroy the bottom board the bees may not have a bottom entrance and the colony could be more difficult to move. As termites seek wood to feed upon and live in hive, so beekeepers need to avoid putting wooden equipment in direct contact with the ground. If some occasional insects become locally abundant, the usual solution is to move the apiary site. Allowing bees full access to all parts of the hive, especially the inner cover area, and confining weak colonies to equipment they can inhabit and protect may reduce or eliminate these and other hive inhabitants. Stacking stored equipment in closed stacks and fumigating the stacks can keep most insects out of the stored equipment [26].

3. Recommendations for control of honey bee insect pests

The succeeding methods either individually or in combination with other integrated methods of pests control are recommended to improve productivity of honey bees and their health welfare. The most effective method for preventing wax moth damage in hives occupied by bees is to maintain strong colonies as bees can remove the moth larvae and repair the damage as it occurs. Stored equipment can be protected against wax moths by fumigating it with Para-dichlorobenzene crystals or by stacking honey supers in a crisscross fashion in open sheds. The penetrating air and daylight discourage colonization by moths. Some beekeepers store supers in enclosed barns with a lighted bug-zapper running constantly to kill emerging adult moths. This practice can eventually eradicate moths from the room. Good hive management has effect of different honey bee diseases and pests and can be reduced by improved management techniques such as strengthening colony with bees or hatching brood and enlarging colony entrance to aid ventilation. Good bee keeping practices such as avoiding use of contaminated equipment, transfer of infected combs from infected hives are recommended to avoid horizontal and vertical transmission of different honey bee diseases from colony to other near colony [27]. In general, the subsequent colony management tools with integrated other improved beekeeping practices are recommended, maintain a strong bee in each hive, inspect every hive at least once a month and move the hive to disrupt the life cycle of honey bee pests. Maintain close mowing or bare ground around the hive to facilitate chemical controls and provide less shelter for beetle larvae by leaving the hive unpleasant to pupating population. The spread and entrance of some honey bee insects is associated with delivery of contaminated apiary equipment's such as wax foundation sheets. Establishing quarantine measures through legal regulation and enforcement on introduction of honey bees and equipment can reduce introduction of insects from infested areas. During introduction of colony bee to a given locality, providing of healthy stock of bee and educating bee keepers about the risk of buying infected colony are recommended. In general, the subsequent measures are recommended when buying or selling of stock honey bees is taken. Before introducing new species or race of honey bee, it is important to study its potential (diseases and pest resistance) quality, foraging behavior and availability of forage. In terms of introducing and buying of stock of bee from market or regions to locality areas, well quarantine and inspection is essential. During introduction of honey bee equipment from abroad to country proper inspection of instruments is recommended [28, 29].

4. Integrated Pest Management

There are alternatives to maintain a relatively pest free and healthy bee colony without the use of pesticides. For professional beekeepers the answer is an emerging adoption of IPM that stands for Integrated Pest Management. The IPM is an effective and environmentally sensitive approach to pest management that utilizes a combination of common sense practices. A goal of IPM is to manage these pest populations, keeping their populations below a level where damage can be tolerated. This level is called an economic injury level and IPM means not relying on a single pest control scheme i.e., not relying exclusively on a chemical pesticide as the solution. The IPM techniques can be employed to keep insect populations below a point where they do not cause unacceptable monetary losses to beekeepers. Keeping strong colonies and protecting stored equipment are the best ways to avoid damage from wax moths. Although trapping of active moths is most effective, the eggs, larvae and pupae must be destroyed as well. A good IPM program involves selection, integration and implementation of a mixture of pest control strategies (biological, cultural and chemical) based on predictable economic, ecological or sociobiological consequences. In other words, IPM attempt to solve insect pest problems while keeping the cost to both ecosystem and human society in mind [30, 31, 32].

5. Conclusion

Honey bee is an outstanding insect and as such it is often necessary to look at the colony as a whole to determine damage by insects or pests. Honey bees are fortunate in that they have relatively few insect pests. This is due in part to the fact that they are not native to some areas, where they originated, but honey bees are not bothered by many other animals. In local areas a pest like wax moths or ants may be of some consequence; wax moths annually destroy millions of dollars' worth of bee comb especially in the warmer season to encounter and give recommendations for their control. Active colonies on hive stands may usually be protected against termite attacks. Keep equipment stacks and spare equipment free from contact with the ground. Integrated Pest Management (IPM) for beekeepers is an effective and environmentally sensitive approach to pest management that utilizes a combination of commonsense practices. Spot treatments only when and where insect populations exceed threshold numbers and vigorous use of the entire arsenal of an integrated population management can best serve beekeepers, our bees and our clientele in the long run. When pest control is needed, integrated pest management uses a combination of strategies to manage pest populations. It is not biological control, although biological control is a useful tactic, and IPM is not an organic program although beekeepers may integrate organic materials into control tactic. Nor is IPM anti-pesticide, but generally it attempts to reduce chemical dependency with a mix of control tactics. Control of insects in bee colonies needs to move from dependence on one or a few pesticide chemicals to a balanced IPM approach. If beekeepers are in doubt as to the cause of a problem it is best to seek expert assistance before attempting to any control procedure.

6. References

1. Neumann P, Carreck NL. Honey bee colony losses. Journal of Apicultural Research. 2010; 49(1):1-6.
2. Ellis J, Evans JD, Pettis JS. Reviewing colony losses and Colony Collapse Disorder in the United States. Journal of Apicultural Research. 2009; 49:134-136.

3. Van Engelsdorp D, Hayes J, Underwood RM, Pettis PS. A survey of honey bee colony losses in the United States, fall 2008 to spring 2009. Journal of Apicultural Research. 2010; 49(1):7-14.
4. Amssalu B, Alemayehu G, Taye N, Desalegn B. Management practices to prevent wax moth: A pest of honey bees. Holeta Bee Research Center, Annual Report, 2011.
5. Fries D, Lindstrom B. Breeding diseases resistant Honey bees. Swedish University of Agricultural Science. 2010, 1-21.
6. Currie RW, Pernal SF, Guzman-Novoa E. Honey bee colony losses in Canada. Journal of Apicultural Research. 2010; 49:104-106.
7. Vejsnaes F, Nielsen SL, Kryger P. Factors involved in the recent increase in colony losses in Denmark. Journal of Apicultural Research. 2010; 49:109-110.
8. Morse R, Nowogrodzki R. Honey bee pests, predators and diseases. 2nd ed. Ithaca N.Y., Cornell University Press, 1990.
9. Mustafa Williams R. New record of the small hive beetle in Egypt and notes on its distribution and control. Bee World. 2002; 83(3):99-108.
10. Amssalu B, Desalegn B. Occurrence of small hive beetle (Aethina tumida Murray; Coleoptera: Nitidulidae) in honeybee (Apis mellifera L. Ethiopian Veterinary Journal. 2006; 10(2):101-110.
11. Amssalu B, Desalegn B. Study on the ecological distribution of small hive beetles in maize-coffee growing areas, 2008.
12. Williams GR, Tarpy DR, VanEngelsdorp D, Chauzat MP, CoxFoster DL, Delaplane KS *et al.* Colony collapse disorder in context. Bioessays. 2010; 32(10):845-846.
13. Rhodes J. Exotic pests of honey bees. Prime Fact 2006; 46:4.
14. Ben Hamida B. Enemies of bees. In: Colin M.E., Ball B.V., Kilani M. (eds.). Bee disease diagnosis. Zaragoza: CIHEAM, 1999, 147-165.
15. Adeday G, Shiferaw M, Abebe F. Prevalence of Bee Lice Braula coeca (Diptera: Braulidae) and Other Perceived Constraints to Honey Bee Production in Wukro Woreda, Tigray Region, Ethiopia. Global Veterinaria. 2012; 8(6):631-635.
16. Gizachew G, Sefinew A, Amssalu B, Malede B. Prevalence and Associated Risk Factors of Bee Lice in Holeta and its Surroundings, Ethiopia. Journal Veterinary Science Technology. 2013; 4:130.
17. Sarwar M. Insect Vectors Involving in Mechanical Transmission of Human Pathogens for Serious Diseases. International Journal of Bioinformatics and Biomedical Engineering. 2015; 1(3):300-306.
18. Sarwar M. Insect Borne Diseases Transmitted by Some Important Vectors of Class Insecta Hurtling Public Health. International Journal of Bioinformatics and Biomedical Engineering. 2015; 1(3):311-317.
19. Desalegn B. Assessment of the effect of ant (Dorylus fulvus) on honeybee colony (A. mellifera) and their products in West & South-West Shoa Zones, Ethiopia. Ethiopian Journal of Animal Production. 2007; 7(1):12-26.
20. Punchihewa RWK. Beekeeping for Honey Production in Sri Lanka - Management of Asiatic Hive Honeybee Apis cerana in its Natural Tropical Monsoonal Environment, 1994.
21. Amssalu B, Desalegn B. Developing ant protection methods and assessing their performances. Published in the 1st Proceedings of National Conference of Ethiopian Beekeeping Association. Addis Ababa, Ethiopia. 1999, 83-89.
22. Matsuka M, Verma LR, Wongsiri S, Shrestha SK, Partap U. Asian beekeeping. Apicultural Association Conference. 2000, 264.
23. VanEngelsdorp D, Hayes J, Underwood RM, Pettis J. A survey of honey bee colony losses in the U.S., fall 2007 to spring. PLOS ONE. 2008; 3:1-6.
24. Stankus T. A review and bibliography of the literature of honey bee Colony Collapse Disorder: A poorly understood epidemic that clearly threatens the successful pollination of billions of dollars of crops in America, J Agr Food Inform. 2008; 9:115-143.
25. Cane JH, Tepedino VJ. Causes and extent of declines among native North American invertebrate pollinators: detection, evidence, and consequences. Conservation Ecology. 2001; 5(1):1.
26. Aizen MA. The Global Stock of Domesticated Honey Bees Is Growing Slower Than Agricultural Demand for Pollination. Current Biology. 2009; 19:1-4.
27. Stokstad E. The Case of the Empty Hives. Science. 2007; 316:970-972.
28. Potts SG, Roberts SPM, Dean R, Marris G, Brown MA, Jones R *et al.* Declines of managed honey bees and beekeepers in Europe. Journal of Apicultural Research. 2010; 49(1):15-22.
29. Tesfay H. Honey Bee Diseases, Pest and Their Economic Importance in Ethiopia. International Journal of Innovation and Scientific Research. 2014; 10(2):527-535.
30. Sarwar M. Frequency of Insect and mite Fauna in Chilies *Capsicum annum* L., Onion *Allium cepa* L. and Garlic *Allium sativum* L. Cultivated Areas, and their Integrated Management. International Journal of Agronomy and Plant Production. 2012; 3 (5): 173-178.
31. Sarwar M. Integrated Pest Management (IPM) - A Constructive Utensil to Manage Plant Fatalities. Research and Reviews: Journal of Agriculture and Allied Sciences. 2013; 2(3):1-4.
32. Sarwar M. Development and Boosting of Integrated Insect Pests Management in Stored Grains. Research and Reviews: Journal of Agriculture and Allied Sciences. 2013; 2(4):16-20.